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(54) Gear box and vehicle incorporating the gear box.

(57) A gear box for use in a road-sweeping vehicle has similar gear rings, (23), (24) on a main input shaft (12) and a main output shaft (14) respectively. Further, co-axial gear rings (29), (30) are provided for transmitting drive to hydraulic pumps (18), (19) associated with the gear box and from an hydraulic motor (20) associated with the gear box. A pair co-axial transmission elements (25), (32) is provided for transmitting drive between the gear rings. The transmission elements are moved axially by a single selector and are coupled together by means of a thrust bearing (33).

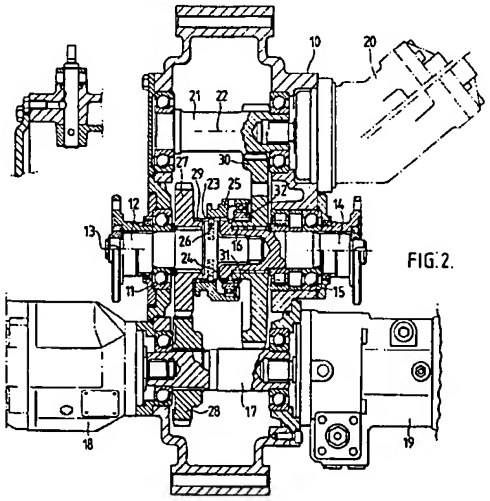

FIG.2.

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Description of Invention

The present invention relates to a gear box used in a self-propelled vehicle incorporating devices which are driven from the main propulsion engine of the vehicle.

In many cases, self-propelled vehicles incorporating powered devices have been provided with auxiliary engines for driving these devices. In order to avoid the cost of an auxiliary engine and to minimise the weight of the vehicle. it has been proposed to incorporate a gear box which enables drive to be transmitted from the main propulsion engine to auxiliary devices on the vehicle.

An example of a known vehicle having a gear box for transmitting drive from a main propulsion engine of the vehicle to auxiliary devices is a road-sweeping vehicle. During a sweeping operation, the vehicle is required to be driven at very low speed along a road and rotary brushes and a fan are required to be driven. A known gear box incorporated in a road sweeping vehicle has a main input member which is coupled with a main propulsion engine in the vehicle, a main output member which is coupled with driven road wheels of the vehicle and an axially displaceable gear ring for coupling the main input member with the main output member, when the vehicle is required to be driven along roads at normal speeds and a sweeping operation is not taking place. The gear ring can be displaced along the axis of the main input member to a second position, in which the gear ring can transmit drive to an auxiliary output member. The auxiliary output member is connected with one or more hydraulic pumps which supply hydraulic fluid for driving the rotatable brushes and the fan.

When the gear ring of the known gear box is in its second position, it does not couple the main output member with the main input member. For driving the main output member at a relative low speed, there is provided an hydraulic motor and a gear train for transmitting drive from the hydraulic motor to the main output member and thence to driven road wheels of the vehicle. Hydraulic fluid under pressure is supplied to the hydraulic motor from one of the pumps associated with the auxiliary output member of the gear box. The gear train is spaced radially from the axis of the main input member and includes, for example, a relatively large diameter gear ring on the main output member.

According to a first aspect of the present invention, there is provided a gear box comprising a main input member, a main output member, an auxiliary output member, an auxiliary input member and coupling means for releasably coupling the main input member and the main output member with each other for rotation together, releasably coupling the main input member with the auxiliary output member and for releasably coupling the auxiliary input member with the main output member, the coupling means being characterised by first and second co-axial transmission elements which are arranged for relative rotation and for axial movement together between a first position in which they couple the main input member with the main output member and a second position in which they couple the main input member with the auxiliary output member and the auxiliary input member with the main output member.

The co-axial arrangement of the transmission elements of a gear box embodying the present invention enables the gear box to be produced at lower cost than the known gear box and facilitates a reduction in overall size and therefore in overall weight of the gear box.

According to a second aspect of the invention, there is provided a vehicle comprising a propulsion engine, driven wheels, at least one auxiliary, powered device and a gear box according to the first aspect of the invention, the gear box being arranged for transmitting drive from the propulsion engine to the driven wheels only or from the propulsion engine to the auxiliary, powered device and also to the driven wheels, through the intermediary of a hydraulic pump and motor combination. Generally, the driven wheels will be ground-engaging wheels but it would be within the scope of the invention to arrange the driven wheels to run on tracks incorporated in the vehicle.

An example of a gear box embodying the first aspect of the invention will now be described, with reference to the accompanying drawing, wherein:

FIGURE 1 shows an end view of the gear box and **FIGURE 2** shows a cross section through the gear box.

The gear box comprises a housing 10 in which there is fitted a hearing 11 supporting a main input member 12 for rotation about an axis 13. In the example illustrated, the main input member 12 is a shaft having a length which is similar to the corresponding dimension of the gear box and which lies partly inside the gear box and partly outside the gear box. As shown, a flange may be provided on the protruding part of the shaft 12 to facilitate coupling with a further drive shaft (not shown).

A main output member 14 is supported by a further bearing 15 for rotation relative to the housing and relative to the input shaft 12 about the axis 13. A third bearing 16 is interposed between mutually overlapping portions of the members 12 and 14 to maintain the co-axial relation of these members. The member 14 also is a shaft having a length similar to the corresponding dimension of the gear box and including a connecting flange on a protruding portion of the member 14.

An auxiliary output shaft 17 is supported in the housing 10 by a pair of spaced bearings. The shaft 17 is parallel to but is spaced from the main input shaft 12. Hydraulic pumps 18 and 19 are mounted on the outside of the housing 10 in alignment with the shaft

17 and respective rotors of these pumps are coupled with the shaft 17 to be driven thereby.

An hydraulic motor 20 is mounted on the outside of the housing 10 at a position spaced from the pumps 18 and 19 and also spaced from the main input shaft 12 and the main output shaft 14. An auxiliary input member 21 extends into the housing from the motor 20 and is supported for rotation about an axis 22 which is spaced from but parallel to the axis 13. The auxiliary input member is arranged to be turned about the axis 22 by the motor 20, when the motor is energised.

Ducts are provided for conveying hydraulic fluid from one of the pumps 18 and 19 to the motor 20, in order that the motor can be driven via one of the pumps.

A gear ring 23 is provided on the main input shaft 12 in fixed relation thereto at a position adjacent to the main output shaft 14. A similar gear ring 24 is provided on the main output shaft adjacent to the gear ring 23 and is fixed with respect to the shaft 14. These gear rings have the same number of teeth on the same pitch circle. A first transmission element 25 is provided for transmitting drive between the gear rings 23 and 24. This transmission element has an internal ring of gear teeth which, when the element 25 is in the first position as shown in the upper part of the drawing, are enmeshed with both the gear ring 23 and the gear ring 24. In this position, the element 25 provides direct coupling between the main input shaft 12 and the main output shaft 14 for driving the main output shaft at the same speed as the main input shaft is turned. A spring- loaded detent 26 is provided for releasably retaining the transmission element 25 in its first position.

A pinion 27 is mounted on the main input shaft 12 for rotation relative to that shaft about the axis 13. The pinion 27 has teeth which are enmeshed with teeth of a pinion 28 on the auxiliary output shaft 17. The pinion 28 is keyed to this shaft. The pinion 27 incorporates a second gear ring 29 having the same number of teeth and the same pitch circle as does the gear ring 23. The gear ring 29 is adjacent to the gear ring 23 and is co-axial therewith. The transmission element 25 can be moved axially from the first position shown in the upper part of the drawing to a second position shown in the lower part of the drawing, in which the element 25 is enmeshed with the gear ring 27 and the gear ring 29 but it not enmeshed with the gear ring 28 on the main output shaft 17. When the element 25 is in its second position, drive can be transmitted from the main input shaft 12 to the pumps 18 and 19.

A known selector mechanism (not shown) is provided for moving the transmission element 25 between its first and second positions. The selector mechanism includes a handle remote from the gear box, a selector fork inside the gear box and a linkage between the handle and the selector fork.

The gear box comprises a further gear 30 which is mounted on the main output shaft 14 for rotation relative to that shaft about the axis 13. At its periphery, the gear 30 has teeth which are enmeshed with gear teeth on the auxiliary input member 21. The gear 30 has near to the output shaft 14 and adjacent to the gear ring 24 thereon a gear ring 31 comprising the same number of teeth on the same pitch circle as does the gear ring 24. A second transmission element 32 is provided for transmitting drive from the gear ring 31 to the gear ring 24. The transmission element 32 has internal teeth which, when the first transmission element 25 is in its first position, are enmeshed only with the gear ring 31. When the transmission element is moved to its second position, the transmission element 32 is moved into a second position in which its teeth are enmeshed with both the gear ring 31 and the gear ring 24. A thrust bearing 33 is provided for transmitting axially directed force between the transmission elements 25 and 32, this thrust bearing being interposed between mutually overlapping portions of the transmission elements. It will be noted that the transmission element 25 and the transmission element 32 are co-axial. The transmission element 32 lies substantially at the inside of the transmission element 25. There is no selector fork arranged to act directly on the element 32.

The gear box illustrated in the accompanying drawing is suitable for installation in a road-sweeping vehicle, in substitution for the known gear box commonly provided in such vehicles. The main input shaft 12 is coupled with a known engine, clutch and gear box unit which is typically mounted in a front portion of the vehicle. The gear box shown in the accompanying drawing is typically spaced rearwards from that main propulsion unit and connected thereto by one or more drive shafts. The main output shaft 14 is coupled with driven wheels of the vehicle, typically rear wheels of the vehicle.

Ducts are provided for connecting the pumps 18 and 19 with an hydraulic reservoir (not shown) and with hydraulic motors including the motor 20. Other hydraulic motors arranged to be driven by the pumps 18 and 19 are incorporated in auxiliary, powered devices, including means for driving a fan and means for driving rotary brushes mounted in the vehicle. It will be understood that, in the case of a vehicle having other auxiliary, powered devices, the pumps would be connected with these devices. as required. Typically, one of the pumps 18 and 19 is used to drive the motor 20 alone and the other of the pumps 18 and 19 is used to drive auxiliary devices.

When the vehicle is to be driven along roads to a place at which sweeping is to take place, the transmission elements 25 and 32 are set in their respective first positions so that drive is transmitted from the main input shaft 12 only to the main output shaft 14.

When a sweeping operation is to begin, the transmission elements are moved to their second positions so that direct drive of the main output shaft 14 from the main input shaft 12 is terminated. With the transmission elements in the second position, drive is transmitted from the main input shaft 12 to the pumps 18 and 19. If hydraulic fluid is supplied to the motor 20, then drive will be transmitted from that motor to the main output shaft 14 to drive the vehicle along the road at a relatively low speed, for example up to 5 kilometre per hour.

The features disclosed in the foregoing description, or the following claims, or the accompanying drawings, expressed in their specific forms or in terms of a means for performing the disclosed function, or a method or process for attaining the disclosed result, as appropriate may, separately or in any combination of such features, be utilised for realising the invention in diverse forms thereof.

Claims

1. A gear box comprising a main input member, a main output member, an auxiliary output member, an auxiliary input member and coupling means for releasably coupling the main input member and the main output member with each other for rotation together, releasably coupling the main input member with the auxiliary output member and for releasably coupling the auxiliary input member with the main output member, characterised in that the coupling means comprises first and second co-axial transmission elements arranged for relative rotation and for axial movement together between a first position, in which drive can be transmitted from the main input member to the main output member and a second position in which drive can be transmitted from the main input member to the auxiliary output member and also from the auxiliary input member to the main output member.

2. A gear box according to Claim 1 wherein the coupling means further comprises a thrust bearing for transmitting axial movement from one of the co-axial transmission elements to the other.

3. A gear box according to Claim 1 or Claim 2 further comprising a selector arranged for cooperation with said first co-axial transmission element to displace the first co-axial transmission element along its axis between the first and second positions.

4. A gear box according to Claim 3, with which there is associated a handle and a linkage for transmitting movement from the handle to the selector.

5. A gear box according to any preceding claim comprising respective co-axial gear rings of substantially the same diameter provided on the main input member, the main output member and the auxiliary output member and wherein the first of the co-axial transmission elements has an internal gear ring enmeshed with the gear ring of the main input member and with a selected one of the gear rings on the main output member and the auxiliary output member.

6. A gear box according to Claim 5 wherein the coupling means further comprises a gear ring on the auxiliary input member and co-axial with and adjacent to the gear ring on the main output member and wherein the second of the co-axial transmission elements has an internal gear ring enmeshed with the gear ring of the auxiliary input member and, when the first transmission element is in its second position, also with the gear ring of the main output member.

7. A vehicle comprising a main propulsion engine, driven wheels and auxiliary devices and further comprising a gear box according to any preceding claim arranged for transmitting drive either from the main propulsion engine to the driven wheels or to both the auxiliary devices and the driven wheels via an hydraulic pump and motor combination.

8. A gear box substantially as herein described with reference to the accompanying drawing.

9. Any novel feature or novel combination of features disclosed herein or in the accompanying drawing.

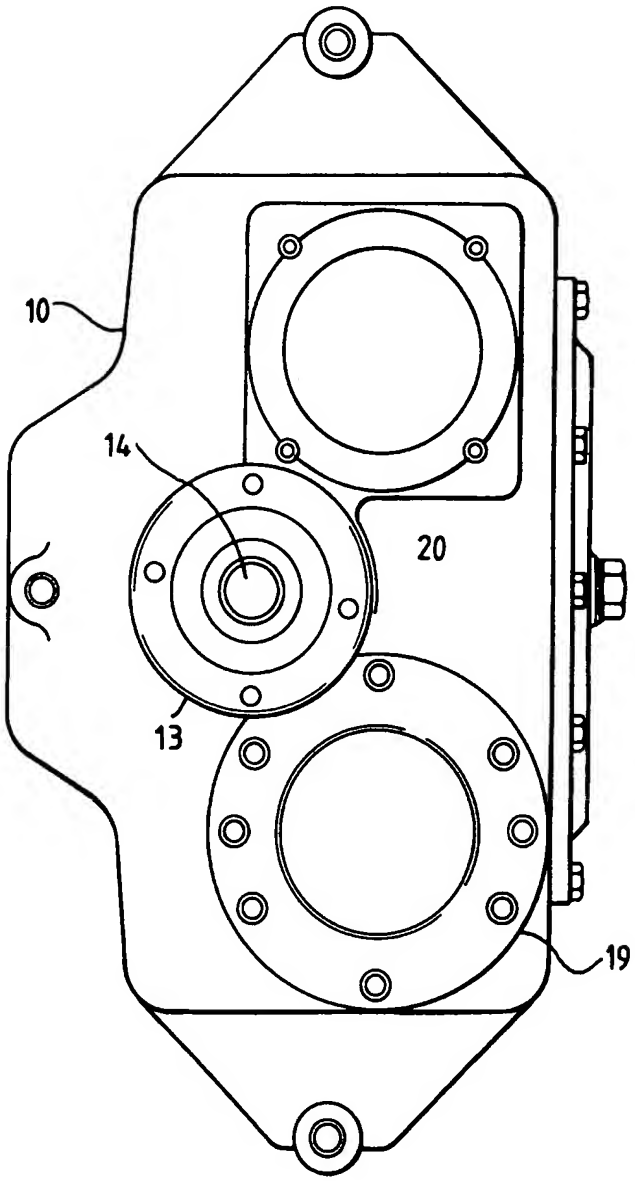

FIG.1.

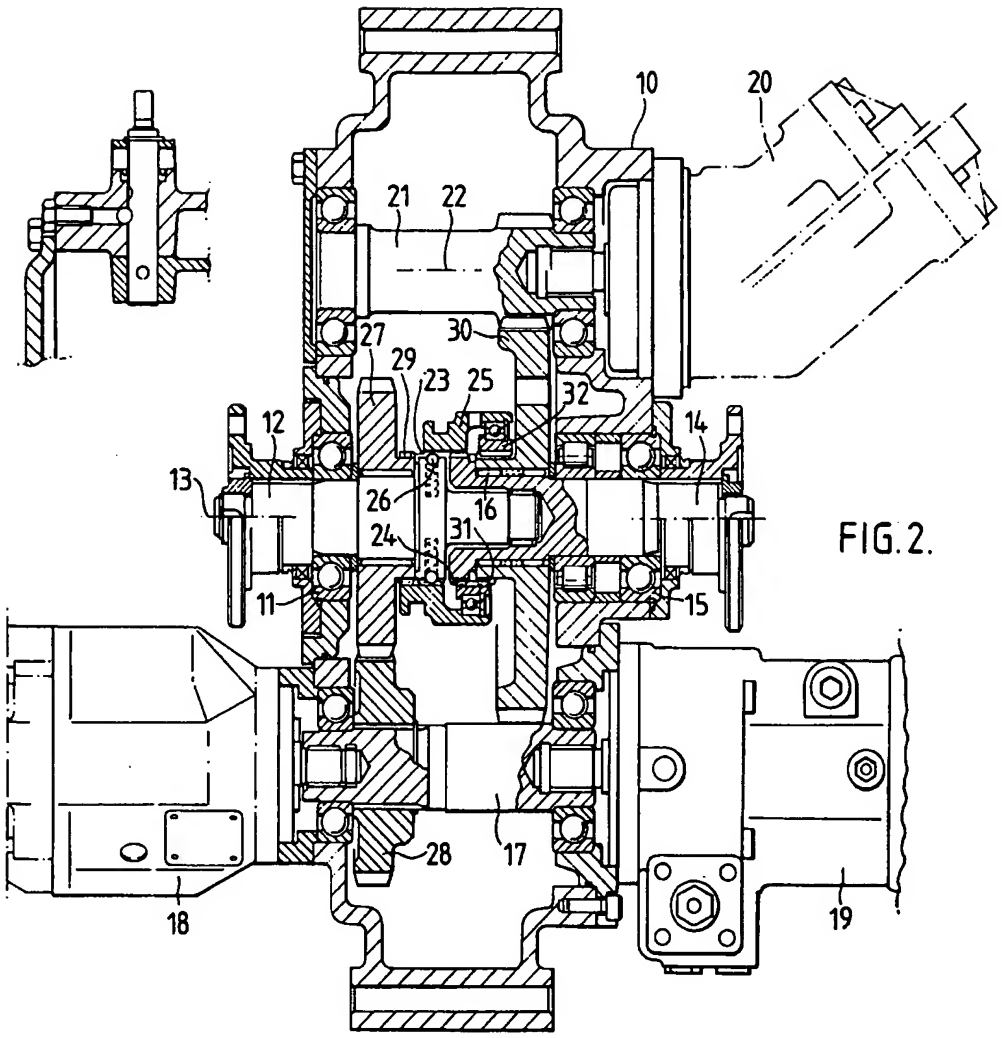

FIG. 2.